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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/347,560	07/06/1999	JOHN ERIK HERSHEY	RD-24.997	4031

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GENERAL ELECTRIC COMPANY
GLOBAL RESEARCH
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SCHENECTADY, NY 12301-0008

EXAMINER	
LIU, SHUWANG	

ART UNIT	PAPER NUMBER
2634	15

DATE MAILED: 03/18/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/347,560	HERSHEY ET AL.
	Examiner	Art Unit
	Shuwang Liu	2634

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *02 January 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1 and 3-11* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1 and 3-11* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments filed 01/02/04 have been fully considered but they are not persuasive. The Examiner has thoroughly reviewed Applicant's arguments but firmly believes that the cited reference reasonably and properly meet the claimed limitation as rejected. In summary, the applicant's arguments related to the rejections have three aspects.

(1) Applicant's argument – The examiner has failed to establish a prima face case of obviousness with respect to claims 1, 6 and 10 in that the asserted combination. Furthermore, the Examiner has not identified any suggestion in the cited patent that the teachings of Braun et al. (or Le Roy) could be used to modify the teachings of Hershey et al. The Examiner has not explained why the combination would be proper.

Examiner's response – In rejecting claims under 35 U.S.C. § 103, the examiner bears the initial burden of presenting a prima facie case of obviousness. See In re Rilckaert, 9 F.3d 1531, 1532, 28 USPQ2d 1955, 1956 (Fed. Cir. 1993) and in re Fine, 837 F.2d 1071, 1074, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). A prima facie case of obviousness is established by presenting evidence that the reference teachings would appear to have suggested the claimed subject matter to one of ordinary skill in the art. See In re Bell, 991 F.2d 781, 783, 26 USPQ2d 1529, 1531 (Fed. Cir. 1993); In re Fritch, 972 F.2d 1260, 1266 n.14, 23 USPQ2d 1780, 1783-84 n.14 (Fed. Cir. 1992); Uniroyal, Inc. v. Rudkin-Wiley Corp., 837 F.2d 1044, 1051, 5 USPQ2d 1434, 1438 (Fed.

Cir. 1988); Ashland Oil, Inc. v. Delta Resins & Refractories Inc, 776 F.2d 281, 293, 227 USPQ 657, 664 (Fed. Cir. 1985).

The Examiner points that Hershey et al. discloses a spread spectrum communication system which is a Geometric Harmonic Modulation (GHM) system over a power line (column 3, lines 11-27). The system comprises a differential encoder and decoder (column 2, lines 38-60 and column 4, lines 31- 44), wherein the system (including encoder and decoder), at least, facilitates identification of transmission errors resulting from a time varying function due to transmission through distribution transformer (column 1, lines 22-41). The Examiner also asserts that Braun et al., in the same field of endeavor, teaches: an exclusive "or" logic unit (2 in figure 5A) having a first input for receiving the digital baseband signal (1); a one bit delay unit (4) having an input coupled to the output of said exclusive "or" logic unit, said one bit delay unit having an output coupled to a second input of said exclusive "or" logic unit; the output (3) of said exclusive "or" logic unit providing an encoded digital baseband signal (d_k); said encoded digital baseband signal coupled to a modulator (11) so as to modulate spread spectrum carrier signal (column 4, lines 4-46 and column 5, lines 35-40).

The Examiner points out that the DPSK is a conventional method used in the GHM system whereby the GHM carrier is inverted or not inverted during a bit duration interval according to the binary state of the data so as the GHM receiver need not correct for frequency selective phase rotation. The Examiner further relies on the benefits of a GHM system with less sensitive to phase distortion introduced by non-linear transformers and resulting in a less complex system by selecting DPSK in the

GHM system (column 4, lines 40-43, Hershey et al.), to conclude that one of ordinary skill in the art would have been motivated to combine the references.

When an obviousness determination relies on the combination of two or more references, there must be some suggestion or motivation to combine the references. See In re Rouffet, 149 F.3d 1350, 1355, 47 USPQ2d 1453, 1456 (Fed. Cir. 1998). The suggestion to combine may be found in explicit or implicit teachings within the references themselves, from the ordinary knowledge of those skilled in the art, or from the nature of the problem to be solved. See id. at 1357, 47 USPQ2d at 1458. Moreover, as long as some motivation or suggestion to combine the references is provided by the prior art taken as a whole, the law does not require that the references be combined for the reasons contemplated by the inventor. See In re Dillon, 919 F.2d 688, 693, 16 USPQ2d 1897, 1901 (Fed. Cir. 1990)(en banc), cert. denied, 500 U.S. 904 (1991) and In re Beattie, 974 F.2d 1309, 1312, 24 USPQ2d 1040, 1042 (Fed. Cir. 1992).

The Hersheys' system has to have differential encoder and decoder in order to solve a problem involves voltage transformer, which are inherently inductively coupled and thereby introduce non-linear phase shifts in a signal passing through the transformer (that is, the transmission errors resulting from a time varying function due to transmission through distribution transformer) (column 1, lines 22-41). Braun et al. (or Le Roy) specify that the arrangement of the encoder and decoder would reduce the harmonic of fundamental frequency on both sides of carrier frequency and eliminate the disturbance factor located in the middle of useful-signal spectrum (see column 3, lines 40-46 and column 4, lines 4-7, Braun et al.). Thus, as stated by the Examiner, the

advantages described by Braun et al. would have motivated one of ordinary skilled in the art to employ the differential encoder and decoder as taught by Braun et al. (or Le Roy) in the system of Hershey et al.

(2) Applicant's argument – Braun et al. teaches away from the claimed invention by using an adder instead of an exclusive "or" logic unit as recited in claims.

Examiner's response – Adder (2) of Braun et al. is a modulo-2 addition. One of ordinary skilled in the art would understand that the modulo-2 addition is equivalent to an exclusive-"or" operation (see the attached pages of a textbook).

(3) Applicant's argument – "it is not appear that the Examiner is correct with respect to his citation of Hershey et al. regarding "identification of transmission error."

Examiner's response – First, Hershey et al. teaches that a problem to be solved involves voltage transformer, which are inherently inductively coupled and thereby introduce non-linear phase shifts in a signal passing through the transformer (column 1, lines 22-41). The examiner recognized that the identifying the phase shift here is identifying transmission errors resulting from a time varying function due to transmission through distribution transformer. Second, the differential encoder and decoder having the same arrangement as the application should be facilitate identification of transmission errors resulting from a time varying function due to transmission through distribution transformer, such as taught by Braun et al.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1 and 6-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hershey et al. (US 5,844,949) in view of Braun et al. (US 4,799,238).

As shown in figures 1-3, Hershey et al. discloses a spread spectrum communication system, which is a Geometric Harmonic Modulation (GHM) system over a power line (column 3, lines 11-27). The system comprises a differential encoder and decoder (column 2, lines 38-60 and column 4, lines 31- 44), wherein the system (including encoder and decoder), at least, facilitates identification of transmission errors resulting from a time varying function due to transmission through distribution transformer (column 1, lines 22-41).

Although Hershey et al. discloses the differential encoder and decoder, they do not teach the encoder or decoder in detail, that is, Hershey et al. does not disclose the encoder comprising an exclusive "or" logic unit, a one bit delay unit and said encoded digital baseband signal coupled to a modulator.

Braun et al., in the same field of endeavor, teaches:

(1) regarding claims 1 and 6:

an exclusive "or" logic unit (2 in figure 5A) having a first input for receiving the digital baseband signal (1);

a one bit delay unit (4) having an input coupled to the output of said exclusive "or" logic unit, said one bit delay unit having an output coupled to a second input of said exclusive "or" logic unit;

the output (3) of said exclusive "or" logic unit providing an encoded digital baseband signal (d_k);

said encoded digital baseband signal coupled to a modulator (11) so as to modulate spread spectrum carrier signal (column 4, lines 4-46 and column 5, lines 35-40).

(2) regarding claim 7:

further comprising the step of utilizing the encoded digital baseband output to modulate a spread spectrum carrier signal (column 5, lines 35-40).

(3) regarding claim 8:

wherein the output of said "or" unit is delayed for one bit period (column 1, lines 65-68).

One skilled in the art would have clearly recognized that the DPSK is a conventional method used in the GHM system whereby the GHM carrier is inverted or not inverted during a bit duration interval according to the binary state of the data so as the GHM receiver need not correct for frequency selective phase rotation. It would be desirable to have a GHM system with less sensitive to phase distortion introduced by non-linear transformers and resulting in a less complex system by selecting DPSK in

the GHM system (column 4, lines 40-43, Hershey et al.). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate DPSK coding scheme of Braun et al. in the GHM system in order to allow the receiver need not correct for frequency selective phase rotation. In so doing, the GHM system is less sensitive to phase distortion introduced by non-linear transformers and resulting in a less complex system.

4. Claims 3-5 and 9-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hershey et al. (US 5,844,949) in view of Le Roy (US 5,822,363).

As shown in figures 1-3, Hershey et al. discloses a spread spectrum communication system which is a Geometric Harmonic Modulation (GHM) system over a power line (column 3, lines 11-27). The system comprises a differential encoder and decoder (column 2, lines 38-60 and column 4, lines 31- 44), wherein the system (including encoder and decoder), at least, facilitates identification of transmission errors resulting from a time varying function due to transmission through distribution transformer (column 1, lines 22-41). Furthermore, Hershey et al. discloses the input of the decoder (33 in figure 3) coupled to the output geometric harmonic modulation Fourier transform unit.

Although Hershey et al. discloses the differential encoder and decoder, they do not teach the encoder or decoder in detail, that is, Hershey et al. does not disclose the decoder comprising a one bit delay unit, a multiplier, a summer and a logic level as recited in claims 3, 4 and 10.

Le Roy , in the same field of endeavor, teaches:

(1) regarding claims 3 and 10:

a one bit delay unit (22) having an input coupled to a filter (20) (column 2, lines 19-23 and lines 58-64);

a multiplier (24) having a first input coupled to the output of the filter, and a second input coupled to the output of said one bit delay unit;

a summer (26) coupled to the output of said multiplier (24);

a logic level (28) determiner coupled to the output of said multiplier said logic level determiner to provide a decoded digital baseband signal.

(2) regarding claim 4:

an encoder having:

an exclusive "or" logic unit (12) having a first input for receiving said digital baseband signal (b_k);

a one bit delay unit (14) having an input coupled to the output of said exclusive "or" logic unit, said one bit delay unit having an output coupled to a second input of said exclusive "or" logic unit;

the output of said exclusive "or" logic unit providing an encoded digital baseband signal (d_k);

said encoded digital baseband signal coupled to a modulator (18) so as to modulate spread spectrum carrier signal (column 2, line 53-column 6, line 21 and column 7, lines 30-59).

a decoder having:

a one bit delay unit (22) having an input coupled to a filter (20);

a multiplier (24) having a first input coupled to the output of the filter, and a second input coupled to the output of said one bit delay unit;

a summer (26) coupled to the output of said multiplier (24);

a logic level (28) determiner coupled to the output of said multiplier said logic level determiner to provide a decoded digital baseband signal.

One skilled in the art would have clearly recognized that the DPSK is a conventional method used in the GHM system whereby the GHM carrier is inverted or not inverted during a bit duration interval according to the binary state of the data so as the GHM receiver need not correct for frequency selective phase rotation. It would be desirable to have a GHM system with less sensitive to phase distortion introduced by non-linear transformers and resulting in a less complex system by selecting DPSK in the GHM system (column 4, lines 40-43, Hershey et al.). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate DPSK coding and decoding schemes of La Roy in the GHM system in order to allow the receiver need not correct for frequency selective phase rotation. In so doing, the GHM system is less sensitive to phase distortion introduced by non-linear transformers and resulting in a less complex system.

(4) regarding claims 5 and 9:

wherein the modulated spread spectrum carrier is coupled a power line (column 1, lines 5-8).

(5) regarding claim 11:

It is inherent in the DPSK encoder that the logic circuit 28 is declaring a logical zero when said product is greater than or equal to zero, and otherwise declaring a logical one.

Conclusion

5. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shuwang Liu whose telephone number is (703) 308-9556.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Chin, can be reached at (703) 305-4714.

Any response to this action should be mailed to:

Commissioner of Patents and Trademarks

Washington, D.C. 20231

or faxed to:

(703) 872-9306 (for Technology Center 2600 only)

Hand-delivered responses should be brought to Crystal Park II, 2121 Crystal Drive, Arlington, VA, Sixth Floor (Receptionist).

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Technology Center 2600 Customer Service Office whose telephone number is (703) 306-0377.

Shuwang Liu
Primary Examiner
Art Unit 2634

March 10, 2004

DIGITAL COMMUNICATIONS

Fundamentals and Applications

BERNARD SKLAR

The Aerospace Corporation, El Segundo, California
and
University of California, Los Angeles

98-04-16P1 :32

P T R Prentice Hall
Englewood Cliffs, New Jersey 07632

[redacted]

Example 2.6 Duobinary Coding and Decoding

Use Equation (2.83) to demonstrate duobinary coding and decoding for the following sequence: $\{x_k\} = 0\ 0\ 1\ 0\ 1\ 1\ 0$. Consider the first bit of the sequence to be a startup digit, not part of the data.

Solution

Binary digit sequence $\{x_k\}$:	0	0	1	0	1	1	0
Bipolar amplitudes $\{x_k\}$:	−1	−1	+1	−1	+1	+1	−1
Coding rule: $y_k = x_k + x_{k-1}$:		−2	0	0	0	2	0

Decoding decision rule: If $\hat{y}_k = 2$, decide that $\hat{x}_k = +1$ (or binary one)

If $\hat{y}_k = -2$, decide that $\hat{x}_k = -1$ (or binary zero).

If $\hat{y}_k = 0$, decide opposite of the previous decision.

Decoded bipolar sequence $\{\hat{x}_k\}$:	−1	+1	−1	+1	+1	−1
Decoded binary sequence $\{\hat{x}_k\}$:	0	1	0	1	1	0

The decision rule simply implements the subtraction of each $\hat{x}_{k-1}$ decision from each $\hat{y}_k$. One drawback of this detection technique is that once an error is made, it tends to propagate, causing further errors, since present decisions depend on prior decisions. A means of avoiding this error propagation is known as *precoding*.

2.12.3 Precoding

Precoding is accomplished by first differentially encoding the $\{x_k\}$ binary sequence into a new $\{w_k\}$ binary sequence as follows:

$$w_k = x_k \oplus w_{k-1} \tag{2.84}$$

where the symbol $\oplus$ represents modulo-2 addition (equivalent to the logical *exclusive-or* operation) of the binary digits. The rules of modulo-2 addition are as follows:

$$0 \oplus 0 = 0$$

$$0 \oplus 1 = 1$$

$$1 \oplus 0 = 1$$

$$1 \oplus 1 = 0$$

The $\{w_k\}$ binary sequence is then converted to a bipolar pulse sequence, and the coding operation proceeds in the same way as it did in Example 2.6. However, with precoding, the detection process is quite different from the detection of ordinary duobinary, as shown below in Example 2.7. The precoding model is shown in Figure 2.39; in this figure it is implicit that the modulo-2 addition producing the precoded $\{w_k\}$ sequence is performed on the *binary* digits, while the digital filtering producing the $\{y_k\}$ sequence is performed on the *bipolar* pulses.

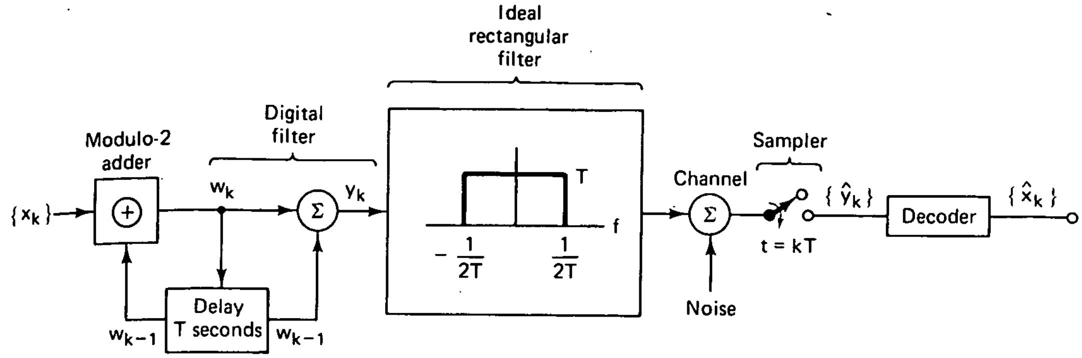

Figure 2.39 Precoded duobinary signaling.

Example 2.7 Duobinary Precoding

Illustrate the duobinary coding and decoding rules when using the differential precoding of Equation (2.84). Assume the same $\{x_k\}$ sequence as that given in Example 2.6.

Solution

Binary digit sequence $\{x_k\}$:	0	0	1	0	1	1	0
Precoded sequence $w_k = x_k \oplus w_{k-1}$:	0	0	1	1	0	1	1
Bipolar sequence $\{w_k\}$:	-1	-1	$+1$	$+1$	-1	$+1$	$+1$
Coding rule: $y_k = w_k + w_{k-1}$:		-2	0	$+2$	0	0	$+2$

Decoding decision rule: If $\hat{y}_k = \pm 2$, decide that $\hat{x}_k$ = binary zero.
If $\hat{y}_k = 0$, decide that $\hat{x}_k$ = binary one.

Decoded binary sequence $\{\hat{x}_k\}$:		0	1	0	1	1	0

The differential precoding enables us to decode the $\{\hat{y}_k\}$ sequence by making a decision on each received sample singly, without resorting to prior decisions which could be in error. The major advantage is that in the event of a digit error due to noise, such an error does not propagate to other digits. Notice that the first bit in the differentially precoded binary sequence $\{w_k\}$ is an arbitrary choice. If the startup bit in $\{w_k\}$ had been chosen to be a binary one instead of a binary zero, the decoded result would have been the same.

2.12.4 Duobinary Equivalent Transfer Function

In Section 2.12.1 we described the duobinary transfer function as a digital filter incorporating a one-digit delay, followed by an ideal rectangular transfer function. Let us now examine an equivalent model. The Fourier transform of a delay can be described as $e^{-j2\pi fT}$ (see Section A.3.1); therefore, the input digital filter of